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DISPLAY DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2015-053320 filed on Mar. 17, 2015, the entire contents of which are incorporated herein by reference.

FIELD

The present invention relates to a display device, and an embodiment of the present invention relates to a pixel structure of a display device.

BACKGROUND

An organic electroluminescence (hereinafter, referred to as “organic EL”) display device includes a light emitting element provided in each of pixels and displays an image by controlling light emission of each of the light emitting elements independently. The light emitting element has a structure in which a layer containing an organic EL material (hereinafter, also referred to as a “light emitting layer”) is interposed between a pair of electrodes, one of which is an anode electrode and the other of which is a cathode electrode.

In such an organic EL display device, one of the electrodes is provided in each pixel as an individual pixel electrode, and the other electrode is provided over a plurality of pixels as a common pixel electrode supplied with a common potential. The organic EL display device provides a potential to the individual pixel electrode provided in each pixel independently, as opposed to the potential of the common pixel electrode, and thus controls the light emission of the pixels.

An EL display device, especially, an organic EL display device realizing full-color display with a combination of a white light emitting element and color filters, generally includes an array substrate and a color filter substrate that are assembled together. The array substrate includes a plurality of light emitting elements arrayed in rows and columns. The color filter substrate includes color filters of three colors, namely, R (red), green (G) and blue (B), and a light-blocking layer (also referred to as a “black matrix”) demarcating the color filters of the three colors.

Occasionally in a display device, an R (red) pixel, a G (green) pixel and a B (blue) pixel are each used as a sub pixel, and a group of these sub pixels is used as one pixel. In such display devices, various arrangements are made on a structure of pixels including the sub pixels in order to improve the display quality. For example, Japanese Laid-Open Patent Publication No. 2012-215830 discloses demarcating pixels by a black matrix. In a liquid crystal display device, a light blocking portion is projected via a cylindrical lens toward a viewer and is visually recognized as a black area. Such black areas are existent intermittently to cause a moire. The above-described arrangement is made in order to prevent this problem and also to solve insufficient write of signals to the pixels. Japanese Laid-Open Patent Publication No. 2009-204898 discloses that each of a plurality of sub pixels is driven at two gray levels and that each sub pixel is divided into two areas having an equal area size and each of the divided areas is driven independently at two gray levels. Such arrangements are made in order to realize various modes of display. Japanese Laid-Open Patent Publication

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No. 2005-085737 discloses dividing each of sub pixels into two areas having an equal area size in an organic EL display device. This arrangement is made in order to prevent excessive temperature rise and thus prevent increase in the light emitting area size of each of pixel areas and also in order to prevent black lines from being widened and thus prevent decrease in display performance. Japanese Laid-Open Patent Publication No. 2009-288735 discloses dividing each of sub pixels into two areas having an equal area size for the following purpose. In the case where a part of the pixel is arranged so as not to be lit up in order to repair a defect, only a divided area having the defect is arranged so as not to be lit up, so that this arrangement is not conspicuous.

SUMMARY

A display device in an embodiment according to the present invention includes a plurality of pixels each including a light emitting region; and a light blocking layer provided on a side of the plurality of pixels on which light is output. In each of the plurality pixels, the light blocking layer has a plurality of openings allowing light from the light emitting region to be output.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view showing a structure of a display device in an embodiment according to the present invention;

FIG. 2 is a plan view showing the structure of the display device in the embodiment according to the present invention;

FIG. 3 is a cross-sectional view showing the structure of the display device in the embodiment according to the present invention;

FIG. 4 is an equivalent circuit diagram of the display device in the embodiment according to the present invention;

FIG. 5 is a plan view showing an array example of sub pixels in the display device in the embodiment according to the present invention;

FIG. 6 is a plan view showing an array example of sub pixels in the display device in the embodiment according to the present invention;

FIG. 7 is a plan view showing an array example of sub pixels in the display device in the embodiment according to the present invention;

FIG. 8 is a plan view showing an array example of sub pixels in the display device in the embodiment according to the present invention;

FIG. 9 is a plan view showing an array example of sub pixels in the display device in the embodiment according to the present invention;

FIG. 10 is a plan view showing an array example of sub pixels in the display device in the embodiment according to the present invention;

FIG. 11 is a plan view showing an array example of sub pixels in the display device in the embodiment according to the present invention;

FIG. 12 is a plan view showing an array example of sub pixels in the display device in the embodiment according to the present invention;

FIG. 13 is a plan view showing an array example of sub pixels in the display device in the embodiment according to the present invention;